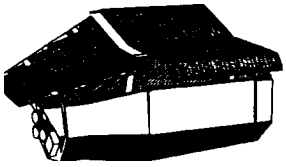
HEAO 2

High Energy Astronomy Observatory 2

Spacecraft Sketch	Mission Objective
	The primary scientific objective of the High Energy Astronomy Observatory (HEAO) mission is to obtain high quality, high resolution data on x-ray, gamma ray and cosmic ray sources. Experiments are flown on three observatories to provide data on the structure, spectra, polarization, synoptic variations and location of these sources. HEAO 1 is designed to survey and map x-ray sources throughout the celestial sphere and to measure low-energy gamma ray flux. HEAO 2 is designed to study sources pinpointed by HEAO 2 and other x-ray spacecraft. HERO 3 is designed to survey the sky for gamma and cosmic rays.

TYPE OF MISSION	PROGRAM OFFICE	PROJECT LEAD CENTER	MANAGEMENT APPROACH	S/C CONTRACTOR	I&T CONTRACTOR
ASTROPHYSICS	SPACE SCIENCE	MSFC	OUT-OF-HOUSE	TRW	TRW

Payload Description

The three High Energy Astronomy Observatory (HEAD 1,21;3) payloads each consist of a unique complement of instruments. The HERO 1 has four x-ray scanning instruments. The HERO 2 has an x-ray telescope with four focal plane instruments and a fifth instrument which is independent of the telescope to measure properties of x-rays beyond the energy range of the telescope. The HEAO 3 carries two instruments for observing cosmic rays and one for exploring the sources of x-ray and gamma ray line emissions. The three HERO observatories use a common bus design differing only to the extent required by the unique mission requirements with the electronic components packaged using a standard modular slice to provide a great degree of flexibility in accommodating the various telemetry and command experiment requirements. For example, reaction wheels are included in the HERO 2 to provide a more precise and highly accurate pointing capability. Since such a pointing capability is not required for celestial scanning, the reaction wheels are not used on HEAD 1 and HEAO 3. The HEAO 2 spacecraft also carries a secondary solar array which is an application of the basic array design. The HEAD 3 spacecraft carries two star trackers, because none are included in the HEAO-3 experiments like in the previous HEAO's.

INSTRUMENT NAME	ACRONYM	PI AFFILIATION	PRINCIPAL INVESTIGATOR	I&T CONTRACTOR
TELESCOPE ASSEMBLY	NONE	GSFC	S. HOLT	AS&E
EXPERIMENT ASPECT SENSOR/SOUTH ATLANTIC ANOMALY DETE	EAS/SAAD	SAO	S. MURRAY	AS&FJSAO
FOCAL PLANE ASSEMBLY	FPA	N/A	NONE	AS&E
FOCAL PLANE CRYSTAL SPECTROMETER	FPCS	MIT	G. W. CLARK	AS&E
HIGH RESOLUTION IMAGER	HRI	SAO	R. GIACCONI	AS&E
HIGH RESOLUTION MIRROR ASSEMBLY	HRMA	N/A	NONE	AS&E
IMAGING PROPORTIONAL COUNTER	IPC	SAO	H. GURSKY	AS&E
MONITOR PROPORTIONAL COUNTER	MPC	SAO	R. GIACCONI	AS&E
OBJECTIVE GRATING/BROAD BAND FILTER SPECTROMETER	OGSBBFS	SAO	L. VAN SPEYBROECK	SAO/AS&E
OPTICAL BENCH	OB	N/A	NONE	AS&E
PRE-COLLIMATOR/SUN SHADE	NONE	N/A	NONE	AS&E
SOLID STATE SPECTROMETER	SSS	GSFC	S. HOLT	GSFC

Instrument Descriptions
The HERO 2 Telescope Assembly, Data Point 400, observes and determines precise location, finite angular size, detailed structure, spectra, and temporal variability of stellar X-ray sources in the range of 0.2-4 KeV. The telescope assembly includes four focal plane instruments, a fifth instrument which is independent of the telescope, and other miscellaneous scientific instrument hardware. The telescope assembly includes all of the scientific instruments and supporting hardware.
The HEAD 2 Experiment Aspect Sensor/South Atlantic Anomaly Detector (EAS/SAAD), Data Point 620, is used to relate Xray images to visible-light star locations. The EAS has three star trackers and two bright object detectors that detect visible light sources with an accuracy of one arc-second. The SAAD has two detectors sensitive to the charged particle type and spectrum in the South Atlantic Anomaly, that are used to reduce the other instrument voltages when passing through the South Atlantic Anomaly.
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The HEAD 2 Focal Plane Crystal Spectrometer (FPCS), Data Point 520, detects emission lines in the wavelength range of 4 to 60 angstroms. The instrument operates on the principle of Bragg diffraction of X-rays from a crystal. Six crystals are used and each crystal can be rocked about 30 arc minutes to scan a spectral region. The detector is a flow-type proportional counter utilizing multiple resistive anodes and charge division circuitry.
The HEAD 2 High Resolution Imager (HRI), Data Point 519, is designed to locate and study X-ray sources in the 0.2 to 4 KeV energy range. The instrument, built by American Science and Engineering, uses three multichannel plate photocathode detectors and two radioactive test sources.
The HEAD 2 High Resolution Mirror Assembly (HRMA), Data Point 621, consists of four concentric sets of grazing-incidence mirrors fabricated from fused quartz. The mirrors are held in confocality by a series of flange assemblies fabricated from a pickle/iron alloy which has a thermal expansion coefficient that closely matches that of fused quartz. This is essentially a focusing device for the focal-plane instruments.
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The HERO 2 Monitor Proportional Counter (MPC), Data Point 518, measures times between acceptable event pulses. The instrument operates concurrently with the focal plane instruments and provides normalization and calibration for those instruments. The proportional counter is viewed through a collimator coaligned with a high resolution telescope to monitor Xray sources in the energy range 1 to 20 KeV.
The HEAD 2 Objective Grating/Broad-Band Filter Spectrometer (OGS/BBFS), Data Point 622, consists of two relatively simple spectrometers used to defract or filter incoming light for other HERO 2 instruments. The OGS performs moderate resolution spectroscopic measurements on sources too weak for the FPCS. The BBFS performs broad band spectral measurements and obtains spectral maps of sources for which the number of elements or angular scale precludes study by the FPCS. The BBFS also is used to enhance the resolution of the HRI and IPC.
The HEAD 2 Optical Bench (OB), Data Point 623, is the main structural element of the HERO 2 Telescope. The OB holds the HRMA in alignment with respect to the FPA. The OB is fabricated from a graphite-epoxy material with a high strength-toweight ratio.terial with a high strength-to-weight ratio.
The HEAO 2 Pre-Collimator/Sun Shade, Data Point 624, is designed to restrict the loss of thermal energy into space and to shade the spacecraft viewing aperture from direct sunlight. This is a very simple device that contains no detectors.
he HEAD 2 Solid State Spectrometer (SSS), Data Point 468, is designed to: 1) measure high sensitivity detection of X-ray sources; 2) measure simultaneously the entire energy bandwidth with high efficiency; and 3) observe X-ray sources with high temporal resolution.

Launch
8/12/77 (1) 11/13/78 (2) 9/20/79 (3)